Sara

Commonwealth of Pennsylvania

DEPARTMENT OF
CONSERVATION AND NATURAL RESOURCES

DEPARTMENT OF
ENVIRONMENTAL PROTECTION

October 18, 2010

Jim Edward, Director
Chesapeake Bay Program Office
410 Severn Avenue
Annapolis, MD 21403

Dear Mr. Edward:

As part of its responsibility to meet the new Environmental Protection Agency's (EPA) Total Maximum Daily Load (TMDL) requirements for the Chesapeake Bay watershed, the Pennsylvania Department of Environmental Protection (DEP) has reached out to partners across the state to improve tracking and reporting of existing best management practices (BMPs). DEP has been working closely with the Pennsylvania Department of Conservation and Natural Resources (DCNR) to improve tracking and reporting of forestry-related Bay BMPs. One of the discoveries made during this process is that, in addition to systematic underreporting of currently recognized BMPs, there are flaws in how the Bay model calculates load reductions off harvested and unharvested forestland.

The following recommendations and background are provided to inform Bay model designers as to calculations that more accurately reflect the loading rates off forestland in Pennsylvania's portion of the Bay watershed. The next opportunity to make changes to the Bay model will occur in early 2011.

The recommendations additionally include support for mapping technology and expertise supplied by DCNR - specifically through applications of lidar imagery - to provide improved data and mapping of Pennsylvania's portion of the Bay watershed, including land-use changes, forest growth rates, and many other uses.

> **Recommendation 1**: The Bay model assumes that 100 percent of all nutrients and sediments on a harvested forest acre not using best management practices runs off the acre and into nearby water bodies. This assumption should be revised as it does not recognize the nutrient-retention capacity of remaining features on a timbered site - including the forest floor, woody debris, residual standing stock, and emergent vegetation - or the influence of seedling regeneration.

Background:

The Bay model currently calculates nitrogen loading from a harvested forested acre in the Pennsylvania Bay watershed at 16 pounds/acre/year. The model assumes that all 12 pounds of airborne nitrogen, as well as four pounds of soil and leaf-litter based nitrogen, leaves the forested acre during a timber harvest as if the harvest were leaving behind a paved surface. This is seldom the case, except for land clearing for some developments, which would be captured in the model by a land-use change.

In reality, some proportion of the nitrogen and phosphorus deposited on a forested acre remains on site during and after a harvest, retained by the residual forest soils, woody debris, and emergent vegetation left on site that intercept precipitation, slow overland flow, and reduce erosion. In addition, studies show that seedling regeneration and nutrient uptake accelerate following a variety of harvest practices. [1] There are no studies comparing runoff from a harvested forest acre to runoff from a parking lot, but the model's assumption of 100 percent loading is clearly not accurate.

Secondarily, because the model's efficiency rates for forest harvest BMPs are based on this faulty baseline, they also may be undercounting nutrient load reductions. Current efficiencies for harvest BMPs of 50 percent nitrogen reduction and 60 percent phosphorus reduction start with the premise that non-BMP harvested acres release 100 percent of site nutrients. For example, if this figure is off by 50 percent due to residual soils, vegetation, and regrowth, then harvesting with BMPs should cut that loading figure in half again. To put this into pounds per year for illustrative purposes, actual loading rates off a harvested acre not using BMPs might be eight pounds of nitrogen per year, so a harvested acre using BMPs with a 50 percent efficiency rate for nitrogen would have an annual loading of four pounds of nitrogen per acre.

Because DCNR alone timbers 11,000 acres within the Bay watershed yearly, all using BMPs; and the Game Commission timbers 5,600 acres within the Bay watershed yearly, all using BMPs; and both agencies promote use of BMPs on privately owned timberlands and game-cooperator lands, it would not be radical to assume at least 20 percent of all harvested forestland in the Bay watershed (out of an estimated total of 102,000 acres) use BMPs and have a drastically lower loading rate for nitrogen, phosphorus, and sediment than now calculated by the Bay model.

> **Recommendation 2**: While the Bay model credits efficiencies of 50 percent nitrogen, 60 percent phosphorus, and 50 percent sediment reduction to BMPs used on timber harvests, it does not provide any credit for BMPs used on non-harvested forestlands. BMPs, such as those used on a well-managed, third-party certified forest, can increase growth rates, carbon sequestration rates, and nutrient uptake by standing stock; thereby reducing nitrogen, phosphorus, and sediment loadings. These BMPs should be built into the model.

Background:

The EPA model estimates average per acre and total loadings of nitrogen, phosphorus, and sediment from Pennsylvania's forested acres. The model uses an assumption that an average 12 pounds of nitrogen per acre, per year falls on forested acres through airborne deposition, and that nearly all of those pounds remain on site. This results in a net average of 2.1 pounds per acre, per year as a loading rate. While this is the lowest loading rate of any land-use category recognized in the Bay model, the sheer number of forested acres in Pennsylvania means the total loadings of nitrogen from forestland is 21,765,802 pounds per year, or 20 percent of the total nitrogen from Pennsylvania's Bay watershed. Similarly, forested acres are assessed a phosphorus loading rate in the model of 0.06 pounds per acre, per year, for a total annual loading of 569,689 pounds per year or 14 percent of Pennsylvania's total sediment.

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[1] See D. Burgess and S. Wetzel, "Nutrient Availability and Regeneration Response After Partial Cutting and Site Preparation in Eastern White Pine," *Forest Ecology and Management*, 2000; also J. Knoepp and K. Elliott, Forest Ecology and Management 211 (2005); P. L. Marks and F. H. Bormann, Science, May 1972.

Similarly, forested acres are assessed a phosphorus loading rate in the model of 0.06 pounds per acre, per year, for a total annual loading of 569,689 pounds per year; or, 14 percent of Pennsylvania's total sediment is calculated at the rate of 0.02 pounds per acre, per year for a total loading rate of 226,211 pounds per year or 18 percent of the total.

Many of the non-harvested forested acres in Pennsylvania, particularly those on public lands, are managed with best management practices that are not currently recognized or counted in the Bay model. DCNR hopes that additional BMPs, including certified forest acres, forest stewardship-plan-guided management, avoided conversion, carbon sequestration, windbreaks, and augmentation of urban and suburban tree canopies, will be recognized and counted in the model. DCNR's own two million acres of state forestland in the Bay watershed, along with the Pennsylvania Game Commission's 1.04 million acres of forestland in the Bay watershed, are all well-managed and follow multiple best management practices. This total means, at minimum, 25 percent of the 10 million acres of forested land in Pennsylvania's Bay watershed have best management practices applied. We would encourage the Bay Program to fund studies to determine the different loading rates these above-referenced forest practices and programs generate so the model can be adjusted accordingly. In some cases, such as windbreaks and forest stand improvement practices, these are already recognized by the National Resource Conservation Service as best practices.

> **Recommendation 3**: Support DCNR's PAMAP lidar applications to help improve current land-use mapping of Pennsylvania's Bay watershed and track other forestry-based information relevant to Chesapeake Bay goals.

Background: Pennsylvania's Chesapeake Bay buffers and tree cover could be quantitatively tracked using repeated PAMAP lidar data collection. With each tree represented as a 3D cloud in the LAS (file format) data it would be possible to not only monitor plantings but measure growth over time. Change in riparian buffers could be measured as well, especially if combined with targeted hyperspectral imagery for mapping species distribution and change. This in turn could be used to indirectly measure the nitrogen content of plants (by examining spectral characteristics in the near infrared). We would encourage the Bay Program to support funding for lidar mapping and applications to help track Bay watershed BMPs and land-use changes in Pennsylvania. We would be happy to discuss our ideas in more detail, and understand that this type of request would come outside the normal scope of the Bay Program's annual funding to the states.

We share your commitment to improving the resources of the Bay and to improving the accurate and comprehensive tracking and reporting of best management practices. Please do not hesitate to contact us for further clarification or discussion of the recommendations listed above.

Sincerely,

John Quigley

John Quigley
Secretary
Department of Conservation and Natural Resources

Sincerely,

John Hanger

John Hanger
Secretary
Department of Environmental Protection

cc: Chuck Fox, Senior Advisor to the EPA Administrator for the Chesapeake Bay